March 4, 1848.

The MARQUIS OF NORTHAMPTON, President, in the Chair.

"On the Corrections necessary to be applied to Meteorological Observations made at particular periods, in order to deduce from them Monthly Means." By James Glaisher, Esq., of the Royal Observatory. Communicated by G. B. Airy, Esq., F.R.S., &c., Astronomer Royal.

The author, under whose immediate superintendence the whole of the magnetical and meteorological observations taken at the Royal Observatory at Greenwich have been conducted, by direction of the Astronomer-Royal, has communicated in the present paper various tabular results deduced from the meteorological observations, reserving for future notice those deduced from the magnetical series. His chief object has been to determine the corrections which are applicable to the results obtained by different observers at various times, so as to render them comparable with one another. The barometrical and thermometrical observations here recorded have been made at every hour of Gottingen mean solar time, during the whole of five years, namely, from the end of 1840 to that of 1845. The mean of each hour represents the results deduced from about 150 observations; those for each month represent about 1800 observations; and those for the year represent upwards of 21,000 observations of each element.

Tables are given representing the excess of the mean value of each element at every hour of observation, in every month, above the mean value for the month; and also the mean of the numbers so found, arranged for the different years, and likewise for the same hours in every month. The numbers were then laid down on paper, as ordinates to a curve of which the times were the abscissæ, and a curve passed through, or very near each point; and the ordinates at every Greenwich hour were measured from that curve, and their values given in a table. The accordance of the results thus obtained for the same hours in the same months of the different years is very close and satisfactory; and shows that observers may obtain very valuable approximate results, by taking a comparatively small number of observations in each day at hours by no means inconvenient in ordinary life, furnishing a close approximation to the mean and extreme values, as well as to the diurnal and annual variations of atmospherical phenomena.

March 9 and 16, 1848.

The MARQUIS OF NORTHAMPTON, President, in the Chair.

"Report of Experiments made on the Tides in the Irish Sea; on the similarity of the Tidal phenomena of the Irish and English Channels; and on the importance of extending the experiments round the

Land's-End and up the English Channel." Embodied in a letter to the Hydrographer, by Captain F. W. Beechey, R.N., F.R.S. Communicated by G. B. Airy, Esq., F.R.S., Astronomer Royal.

The author commences by stating, that the set of the tides in the Irish Sea had always been misunderstood, owing to the disposition to associate the turn of the stream with the rise and fall of the water on the shore. This misapprehension, in a channel varying so much in its times of high water, could not fail to produce much mischief; and to this cause may be ascribed, in all probability, a large proportion of the wrecks in Caernarvon Bay.

The present inquiry has dispelled these errors, and has furnished science with some new and interesting facts. It has shown that, notwithstanding the variety of times of high water, the turn of the stream throughout the north and south Channels occurs at the same hour, and that this time happens to coincide with the times of high and low water at Moricombe Bay, a place remarkable as being the spot where the streams coming round the opposite extremities of Ireland finally unite. These experiments, taken in connexion with those of the Ordnance made at the suggestion of Professor Airy, show that there are two spots in the Irish Sea, in one of which the stream runs with considerable rapidity, without there being any rise or fall of the water, and in the other the water rises and falls without having any perceptible stream; that the same stream makes high and low water in different parts of the channel at the same time; and that during certain portions of the tide, the stream, opposing the wave, runs up an ascent of one foot in three miles, with a velocity of three miles an hour.

The author then enters minutely into the course of the stream; shows that the point of union of the streams from the opposite channels takes place on a line drawn from Carlingford through Peel in the Isle of Man on to Morecombe Bay; and concludes his remarks on this part of the subject, by adverting to the great benefit navigation will derive from the present inquiry.

The author then notices a chart of lines of equal range of tide, which has been compiled partly from the ranges published by the Royal Society*, and partly from observations made on the present occasion; and has annexed a table†, by the aid of which the seaman will be able to compare his soundings taken *at any time of the tide* with the depths marked upon the Admiralty charts.

Next follows the mention of a feature in the motion of the tide-wave, which Captain Beechey thinks has hitherto escaped observation; viz. that the upper portions of the water fall quicker than the lower, or in other words, that the half-tide level does not coincide with the place of the water at the half-tide interval; that this difference in the Bristol Channel amounts to as much as four feet‡, and that the law seems to be applicable to all the tides of the Irish Sea§.

We are next presented with a table (No. 5) exhibiting the various

* Philosophical Transactions, 1836, part 1. † Table X.
‡ See Diagram, No. 9. § Diagram, No. 11.

curves assumed by the tide-wave, and with the durations of the ebb and flood at each place.

Having explained these observations in the Irish Sea, the author proceeds to apply to the tides of the English Channel the law which he found to regulate the stream of the Irish Channel, availing himself of the observations of Captain M. White and others for this purpose. There was no difficulty in adapting the rule in the upper part of the Channel; but below the contraction of the strait, the apparent discordance was so great, that nothing but a reliance on the general accuracy of the observations prevented the inquiry being abandoned.

It seemed that the streams are operated upon by two great forces, acting in opposition to each other; viz. that there is a great offing stream setting along the western side of the British Isles, and flowing in opposition to the tides of the Channel above the contraction, turning the stream with greater or less effect as the site is near to, or removed from, the points of influence. By pursuing this idea, it was immediately seen that the observations in the English Channel respond to it; and then applying it to the offing of the Irish Sea, and considering that channel to comprise within its limits the Bristol Channel, as the English Channel does the Gulf of St. Malo, it was found that the observations there also fully bear out the idea. So that there was afterwards but little difficulty in tracing the course of the water, and bringing into order what before appeared to be all confusion.

The author then traces the great similarity of tidal phenomena of the two channels, and proceeds to describe them. For this purpose he considers the Irish Channel as extending from a line connecting the Land's End with Cape Clear to the end of its tidal stream, or virtual head of the tide at Peel; and the English Channel from a line joining the Land's End and Ushant, to the end of its tidal stream off Dungeness. With these preliminary lines, he shows that both channels receive their tides from the Atlantic, and that they each flow up until met by counter-streams; that from the outer limit of the English Channel to the virtual head of its tide the distance is 262 geographical miles; and in the Irish Channel, from its entrance to the virtual head of its tide, it is 265 miles.

In both channels there is a contraction about midway; by Cape La Hague in the one, and by St. David's Head in the other, and at nearly the same distance from the entrance. In both cases this contraction is the commencement of the regular stream, the time of the movement of which is regulated by the vertical movement of the water at the virtual head of the channel; situated in both cases 145 miles above the contraction, and the actual time of this change, or Vulgar Establishment, is the same in both cases. Below the contraction of the strait, in both cases the stream varies its direction according to the preponderance of force exerted over it by the offing stream. In both cases, between the contraction and the southern horn of the channel, there is a deep estuary (the Bristol Channel and the Gulf of St. Malo) in which the times of high water are nearly the same, and where, in both, the streams, meeting in the channel,

pour their waters into these gulfs, and in both raise the tide to the extraordinary elevation of forty-seven feet. From the Land's End to the meeting of these streams in one case is seventy-five miles, and in the other the same.

In one channel, at Courtown, a little way above the contraction, and at 150 miles from the entrance, there is little or no rise of the water; and in the other, about Swanage, at the same distance from the entrance, there is but a small rise of tide also (five feet at springs). In both cases these spots are the node or hinge of the tide-wave, on either side of which the times of high water are reversed. And again, near the virtual head of the tide, in both cases there is an increased elevation of the water on the south-east side of the channel of about one-third of the column; the rise at Liverpool being thirty-one feet, and at Cayeux thirty-four feet.

The author traces a further identity in the progress of the tide-wave along the sides of both channels *opposite to that of the node.* In the first part of the channel the wave in each travels at about fifty miles per hour; in the next, just above the node, this rate is brought down to about thirty miles per hour in one, and to sixteen miles in the other; it then in both becomes accelerated, and attains to about seventy-six miles per hour.

Lastly, the author observes that the node or hinge of the tide, placed by Professor Whewell (in his papers on the Tides) in the North Sea, is situated at the same distance nearly from the head of the tide off Dungeness, as the node near Swanage is on the opposite side of it; and that in the Irish Channel, at the same distance nearly as the node at Courtown is from the head of the tide off Peel, there is a similar spot of no rise recently observed by Captain Robinson.

The author concludes this paper by urging a further investigation of the tidal phenomena of the English Channel, on the ground of the great advantage navigation, as well as science in general, would derive from such an examination.

Captain Beechey's letter is illustrated by twelve charts and diagrams, showing the identity and singular phenomena of these two great channels.

March 23, 1848.

The MARQUIS OF NORTHAMPTON, President, in the Chair.

"Observations on some Belemnites and other fossil remains of Cephalopoda, discovered by Mr. Reginald Neville Mantell, C.E., in the Oxford Clay, near Trowbridge in Wiltshire." By Gideon Algernon Mantell, Esq., LL.D., F.R.S., Vice-President of the Geological Society.

The author states, that a line of railway now in progress of construction to connect the large manufacturing town of Trowbridge with the Great Western, being part of the Wilts, Somerset, and